

SCI-823-6.81

PID No. 19415

S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD

Hydraulic Report

Submitted _____



Table of Contents

HYDRAULIC NARRATIVE	1
FLOOD HAZARD EVALUATION	2
DRAINAGE AREA MAP	3
RUNOFF CALCULATION.....	4
CHANNEL PHOTOGRAPHS.....	5
SUPPLEMENTAL SITE PLAN.....	6
HYDRAULIC CALCULATIONS FOR THE EXISTING CHANNEL	7-16
HYDRAULIC CALCULATIONS FOR THE PROPOSED CHANNEL	17-28

HYDRAULIC NARRATIVE

Hydraulic Narrative

Project Description

TranSystems Corporation is providing engineering services to the Ohio Department of Transportation (ODOT) for the design of a new bypass state route around the town of Portsmouth, Ohio. The proposed alignment will carry two lanes of traffic, 15 plus miles in either direction, from an interchange with US 52 just east of Portsmouth to another interchange with US 23, located north of Portsmouth in Valley Township. As part of the project new left and right overpass structures will carry the proposed S.R. 823 bypass over Swauger Valley - Minford Road and an unnamed branch of Long Run that runs parallel and to the west Swauger Valley-Minford Road. The bridge to be studied is a two span resting on Mechanically Stabilized Earth (MSE) walls. As requested by the Scope of Services, a hydraulic report is to be submitted before any plan development. The purpose of this report is to investigate the hydraulic impacts.

Design Criteria

The design year storm was selected as the 50 year as per the ODOT criteria. The proposed crossing is not in a Federal Emergency Management (FEMA) regulated flood plain and will be not be required to meet the requirements of the National Flood Insurance Program (NFIP). The proposed structure will be founded on bedrock, therefore scour has not been investigated in accordance with the ODOT Bridge Design Manual Section 203.3.B.

Structure Hydraulics

Structure hydraulics were calculated using HEC-RAS ver. 3.1.3. The channel in the area of the proposed bridge, runs behind the houses along Swauger-Valley Road. The channel is located approximately 115 feet from the center of Swauger Valley-Minford Road. This channel has a stoney bottom with grassy banks up to the bankfull elevations. Looking downstream the right overflow bank adjacent to some houses is mostly grassy with a few trees. The houses appear to be built on a slight rise just outside the overflow bank. It is imperative that the little or rise occur in the overflow areas due to the location of the proposed bridge over Swauger Valley Road. This study used manning numbers of 0.035 for the channel and 0.10 for the overbank in locations outside of the bridge cross sections. Outside the left bank is a wooded hill side. The drainage area was obtained from USGS 7.5 minute Quad Maps. Starting conditions for the HEC-RAS model, used a normal depth set to balance the energy gradient.

FLOOD HAZARD EVALUATION



Flood Hazard Evaluation

The MSE walls being placed well outside the flood area of the creek, have no significant impact on the existing water surface elevations. There is a pier making the bridge at this location a two span structure. The pier is located in the overbank area of the stream. There is minimal increase in flood elevations for the 50 and 100 year floods.

There are several houses located within the Right of Way of the proposed highway that are to be removed as part of the proposed highway design. As these houses are to be removed a slight increase in flooding will not affect these houses. The next closest residential structure is approximately 675 feet upstream from the centerline of SCI-823. Per the detail contour map this house is approximately 30 feet higher than the channel bottom of the stream. Hence, there is no chance of flooding, as a result of the placement of the proposed pier.

These results have been compiled into Table-1.

Table-1 Hydraulic Results

	Existing Conditions 50 Year	Proposed Conditions 50 Year	Existing Conditions 100 Year	Proposed Conditions 100 Year
Q	488.3 cfs	488.3 cfs	575.0 cfs	575.0 cfs
V	8.1 fps	6.5 fps	9.0 fps	6.8 fps
WSE	637.53	638.13	637.67	638.46

DRAINAGE AREA

RUNOFF CALCULATION

SR 823 OVER SWAUGER VALLEY-MINFORD ROAD

**TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A**
U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	24025371.00	SQ. FT.	
	0.862	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	8800.00	FT.	TOTAL CHANNEL LENGTH
	880.00	FT.	L₁₀ = 10% of the Distance along channel
	648	FT.	Elev₁₀ = Elevation at point L₁₀
	7480.00	FT.	L₈₅ = 85% of the Distance along channel
	790	FT.	Elev₈₅ = Elevation at point L₈₅
	6600.00	FT.	Length = L₈₅ - L₁₀
	113.60	FT./MI.	SLOPE = (Elev₁₀ - Elev₈₅)/ Length
		CFS	Q_# = Flood-Peak Discharge # = Frequency of Storm
Q₂	112.71	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q₅	214.50	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q₁₀	294.57	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q₂₅	401.90	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q₅₀	488.25	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q₁₀₀	574.99	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

CHANNEL PHOTOGRAPHS



SR 823 OVER SWAUGER VALLEY-MINFORD ROAD
Downstream of the Proposed Bridge



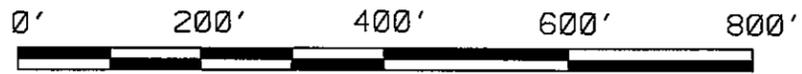
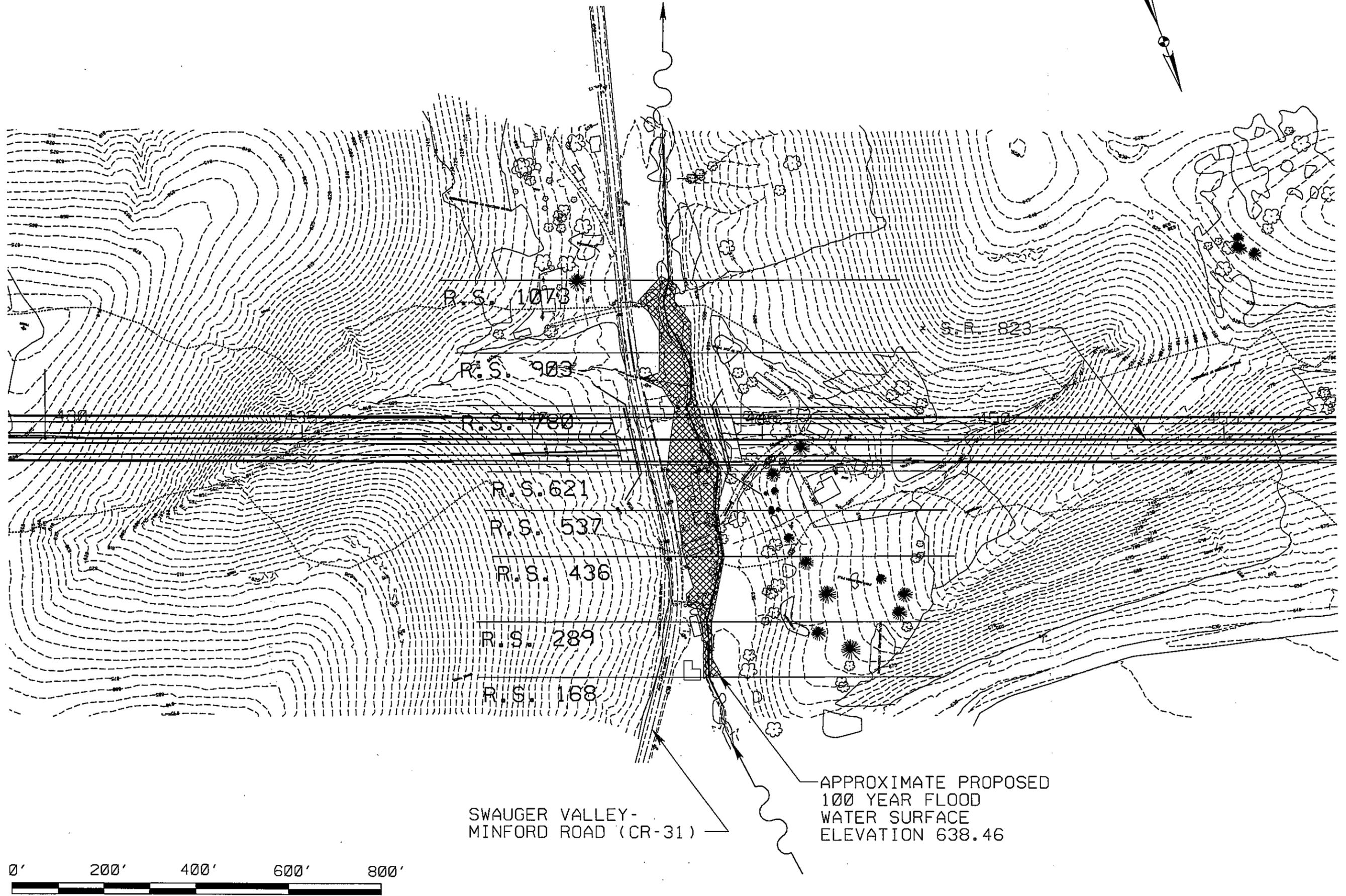
Upstream of the Proposed Bridge



SUPPLEMENTAL SITE PLAN



3:23:26 PM 2/21/2007 c:\c003\0064\bridge\civ\BTS\08-SwaugerValley\Minford\VTSM\B23-1096.ssp001.dgn



SWAUGER VALLEY-
MINFORD ROAD (CR-31)

APPROXIMATE PROPOSED
100 YEAR FLOOD
WATER SURFACE
ELEVATION 638.46



REVIEWED	DATE
P.J.P	2/7/2007
STRUCTURE FILE NUMBER	

DRAWN	MSM
CHECKED	REVISID

SCIO TO CO
STA. 441+00

SUPPLEMENTAL SITE PLAN
BRIDGE NO. SCI-823-0837
SR 823 OVER SWAUGER VALLEY MINFORD ROAD

SCI-823-0.00
PID 19415



**HYDRAULIC CALCULATIONS
FOR
THE EXISTING CHANNEL**

SR 823 OVER SWAUGER VALLEY-MINFORD ROAD

HEC-RAS FOR EXISTING CHANNEL

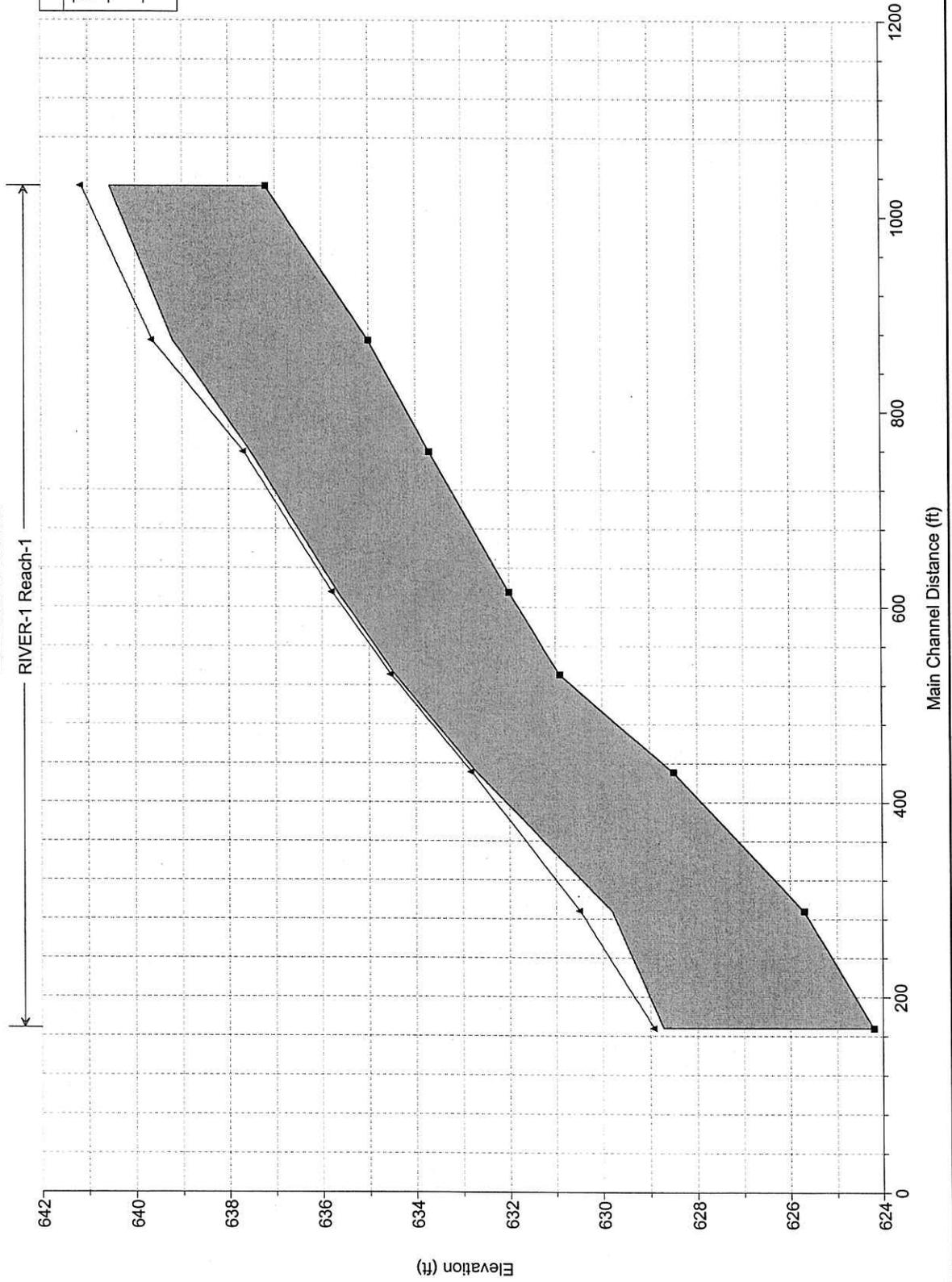
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	1073	Q50	488.30	637.20	640.54	640.54	641.57	0.022397	8.17	59.77	29.35	1.01
Reach-1	1073	Q100	575.00	637.20	641.13	641.13	641.92	0.014427	7.16	85.88	68.64	0.83
Reach-1	903	Q50	488.30	635.00	639.20		639.47	0.004118	4.20	116.14	44.67	0.46
Reach-1	903	Q100	575.00	635.00	639.63		639.91	0.003957	4.20	136.88	51.23	0.45
Reach-1	780	Q50	488.30	633.70	637.53	637.33	638.54	0.017897	8.08	60.45	24.77	0.90
Reach-1	780	Q100	575.00	633.70	637.67	637.61	638.93	0.020966	9.00	64.41	30.07	0.98
Reach-1	621	Q50	488.30	632.00	635.67	635.67	636.12	0.013771	5.64	101.11	118.44	0.78
Reach-1	621	Q100	575.00	632.00	635.79	635.79	636.27	0.013893	5.92	115.24	120.81	0.79
Reach-1	537	Q50	488.30	630.90	634.44	634.44	634.86	0.012534	6.42	107.21	110.13	0.76
Reach-1	537	Q100	575.00	630.90	634.52	634.52	635.01	0.013954	6.90	116.43	110.93	0.80
Reach-1	436	Q50	488.30	628.50	632.71	632.71	633.13	0.009749	5.99	109.64	104.25	0.66
Reach-1	436	Q100	575.00	628.50	632.81	632.81	633.27	0.011270	6.32	120.53	108.12	0.71
Reach-1	289	Q50	488.30	625.70	629.80	629.66	630.95	0.018574	8.62	56.67	21.68	0.94
Reach-1	289	Q100	575.00	625.70	630.48	630.48	631.36	0.011818	7.68	87.99	86.01	0.77
Reach-1	168	Q50	488.30	624.20	628.73	628.73	629.30	0.008710	6.46	104.10	116.64	0.66
Reach-1	168	Q100	575.00	624.20	628.92	628.92	629.48	0.009391	6.61	127.45	130.94	0.69

Stream 20 Plan: Stream 20 2/8/2007 10:11:06 AM

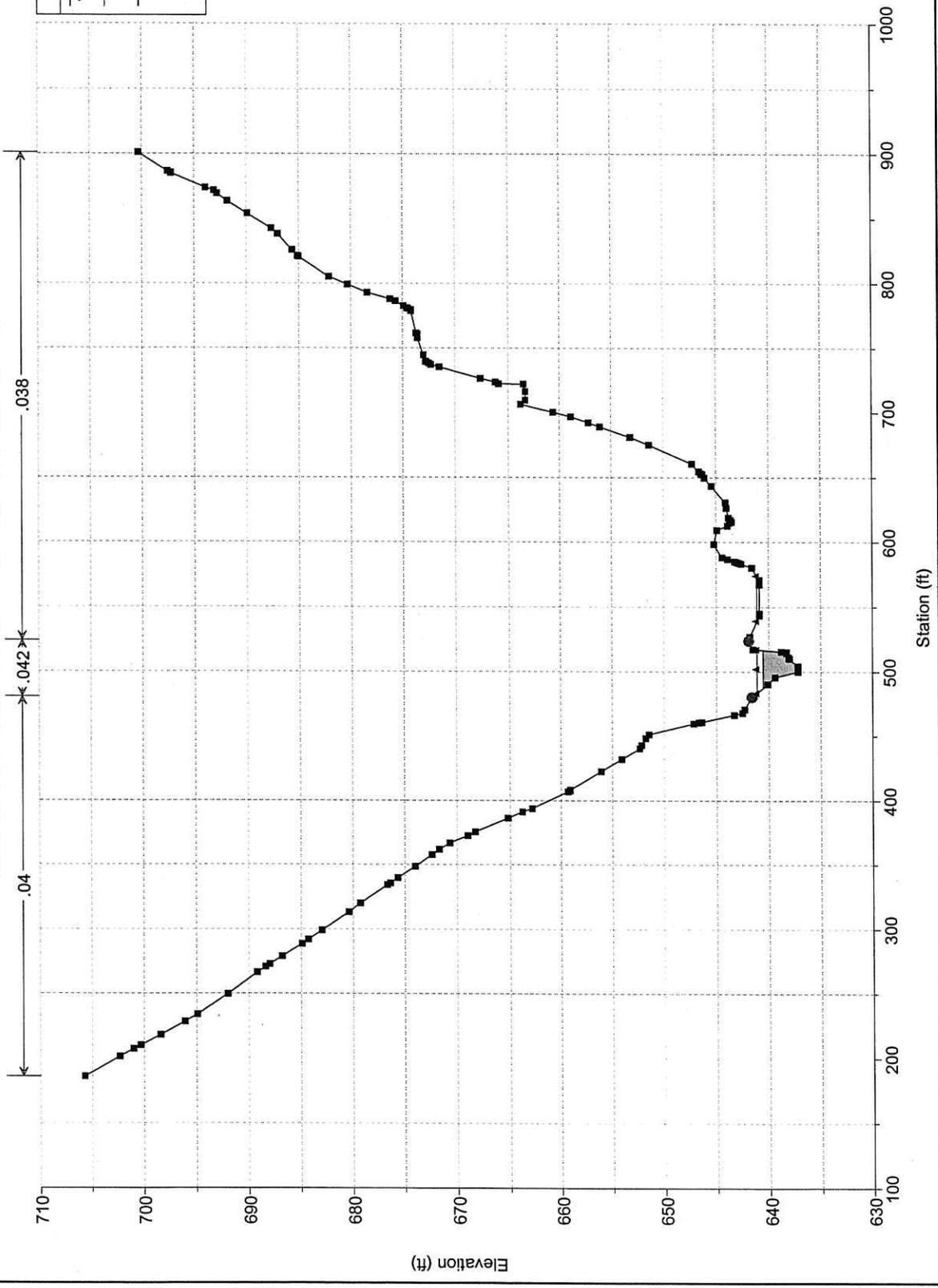
EXISTING CHANNEL

RIVER-1 Reach-1

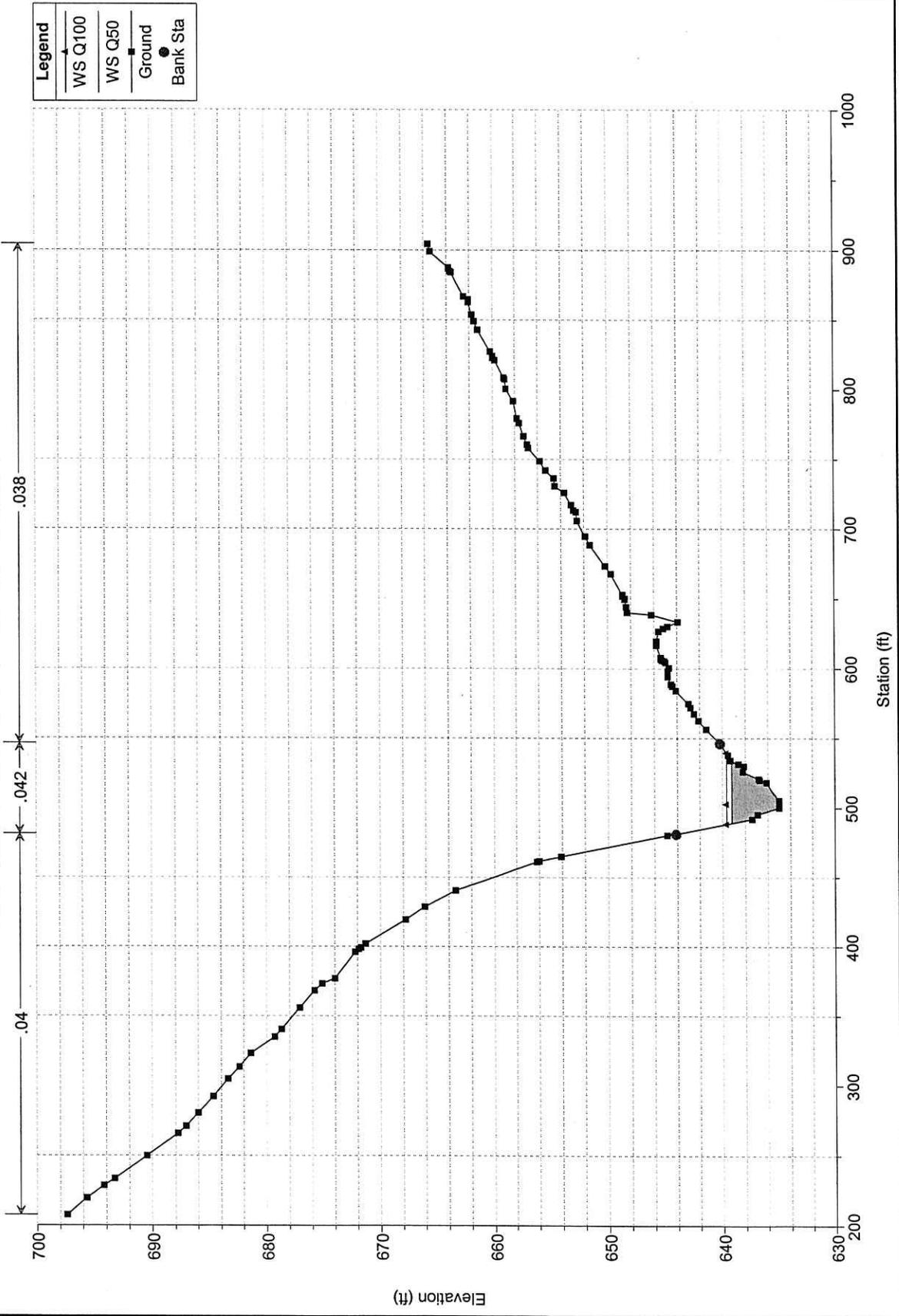
Legend	
WS Q100	▲
WS Q50	▼
Ground	■



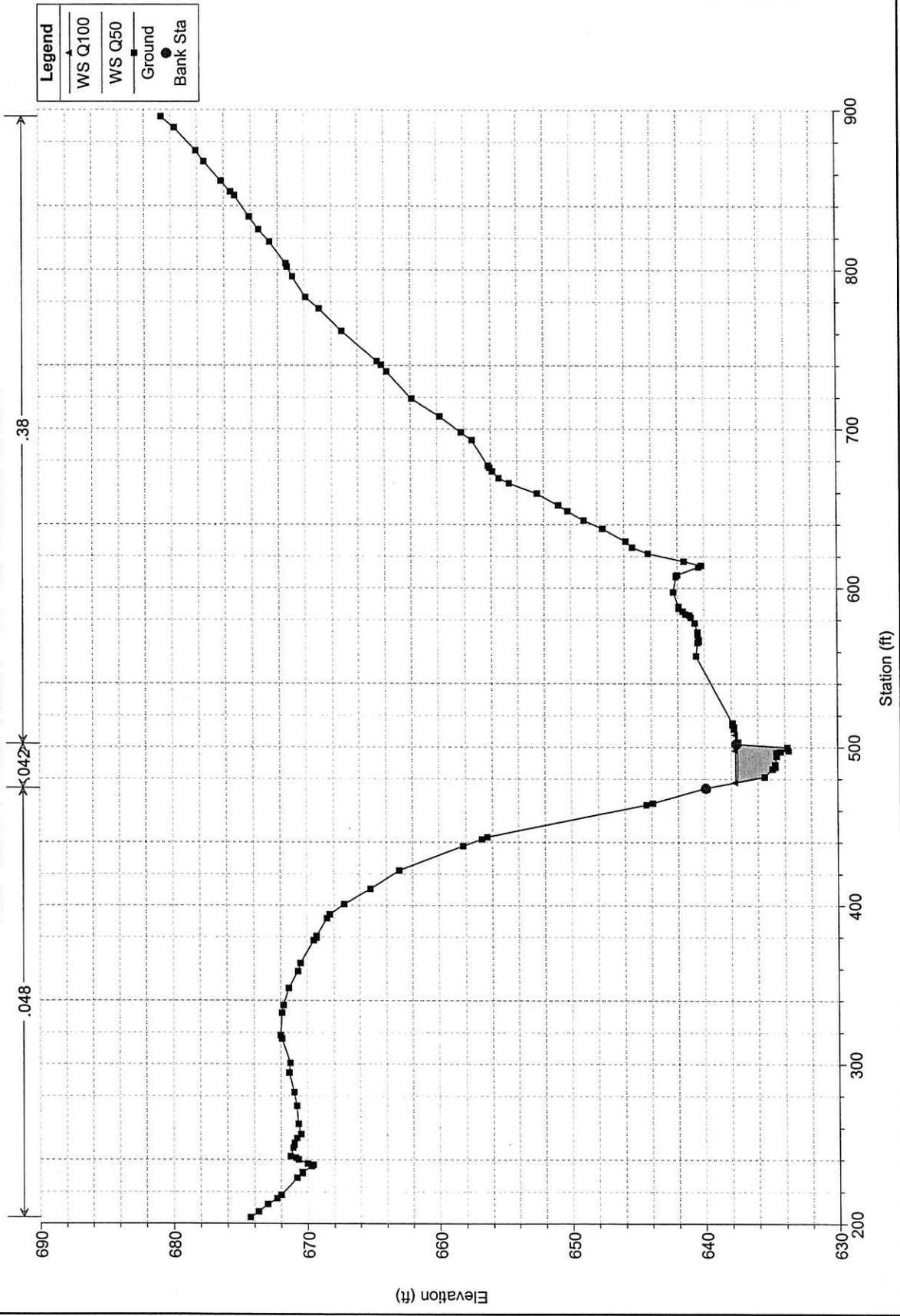
Stream 20 Plan: Stream 20 2/8/2007 10:11:06 AM
River = RIVER-1 Reach = Reach-1 RS = 1073 EXISTING CHANNEL



Stream 20 Plan: Stream 20 2/8/2007 10:11:06 AM
River = RIVER-1 Reach = Reach-1 RS = 903 EXISTING CHANNEL

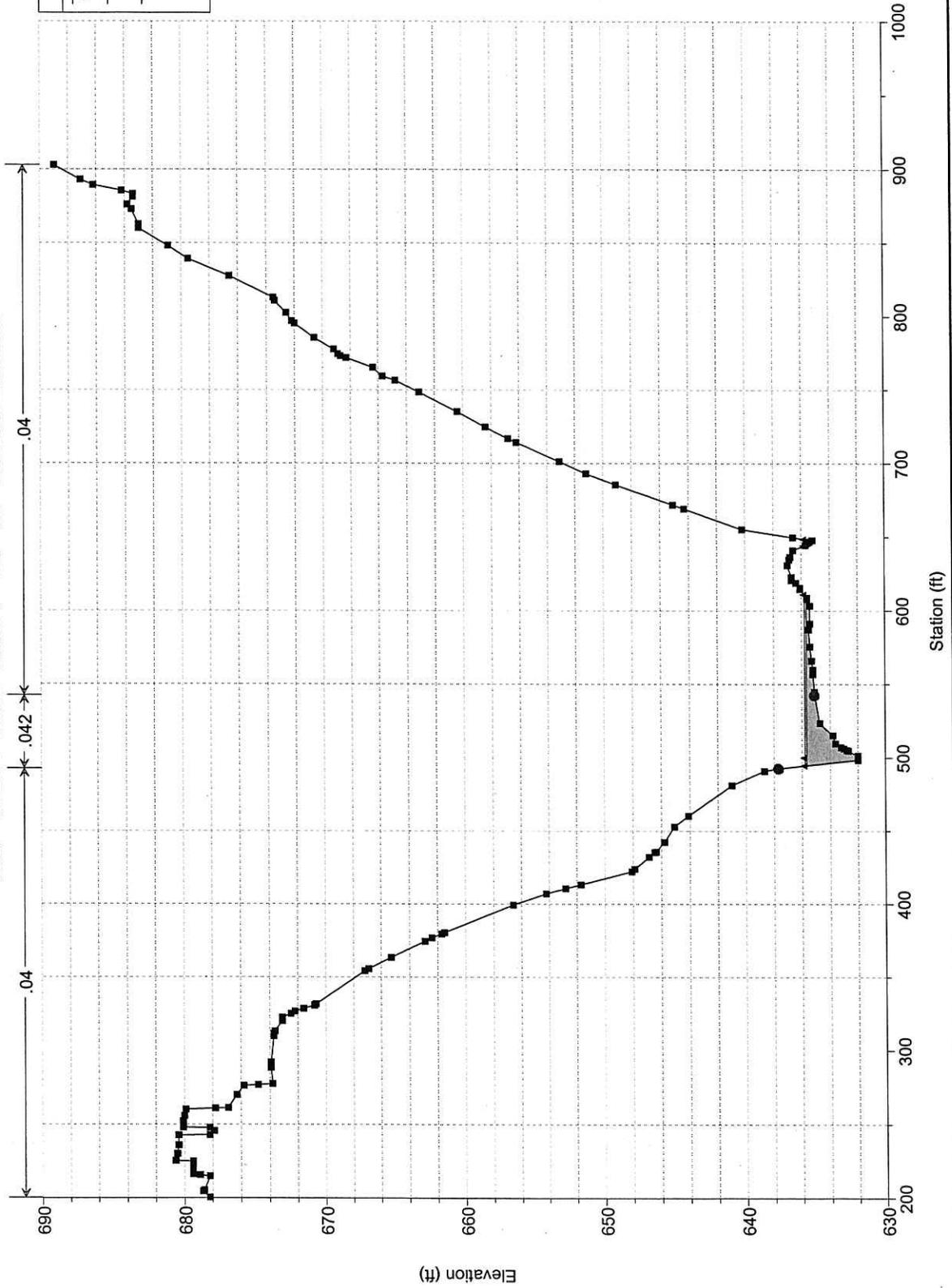


Stream 20 Plan: Stream 20 2/8/2007 10:11:06 AM
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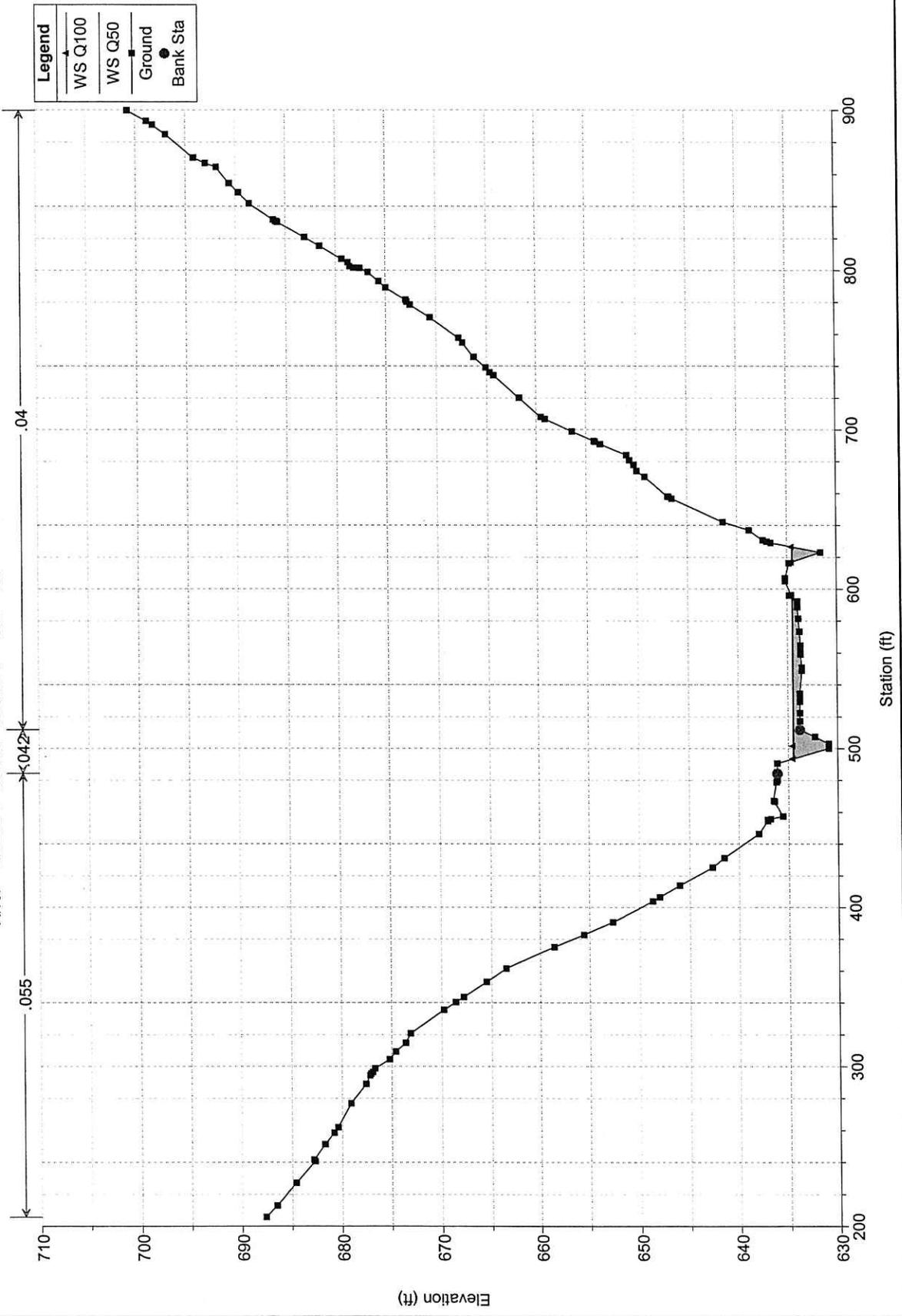


Stream 20 Plan: Stream 20 2/8/2007 10:11:06 AM
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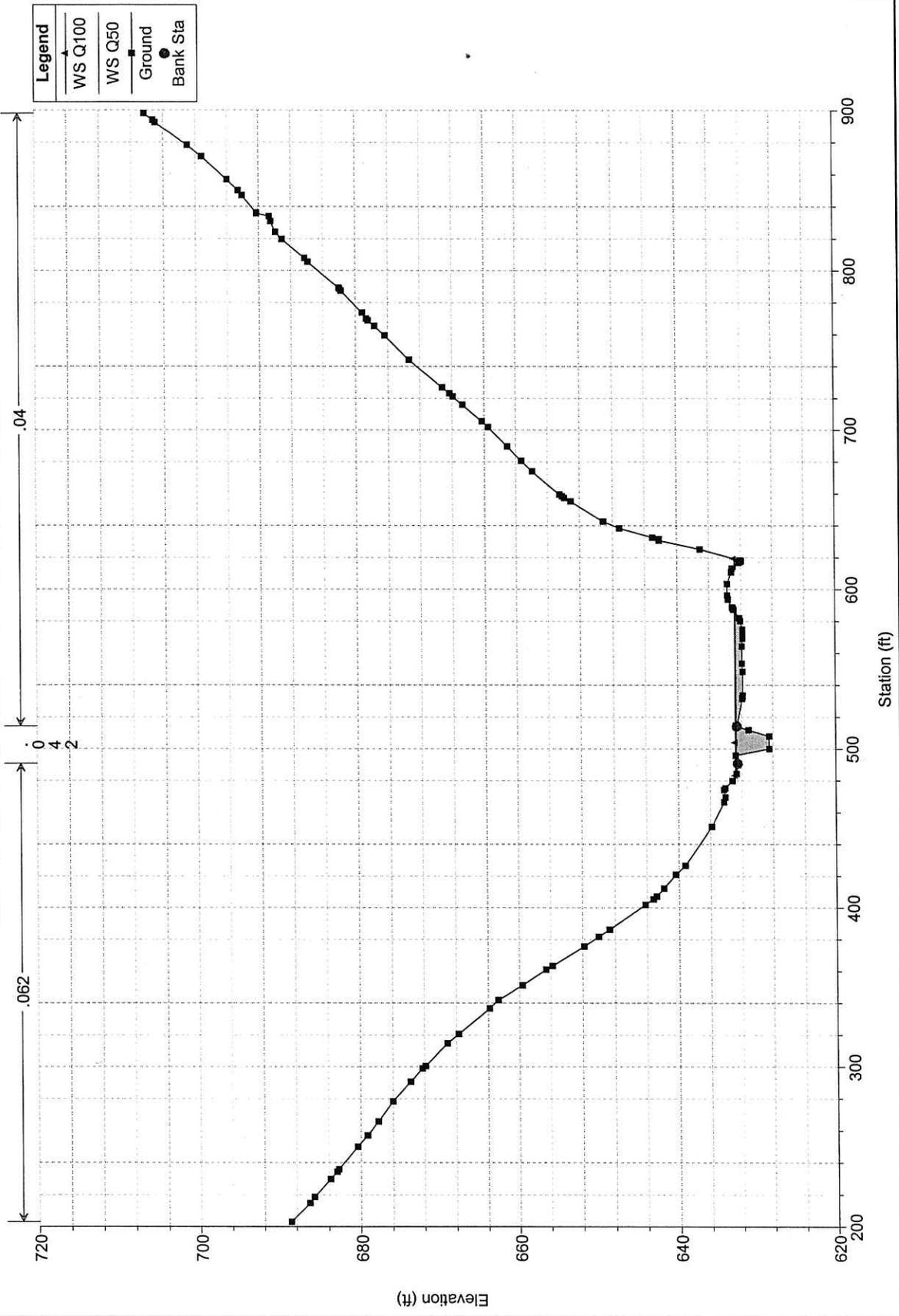
Legend	
—	WS Q100
—	WS Q50
—	Ground
●	Bank Sta



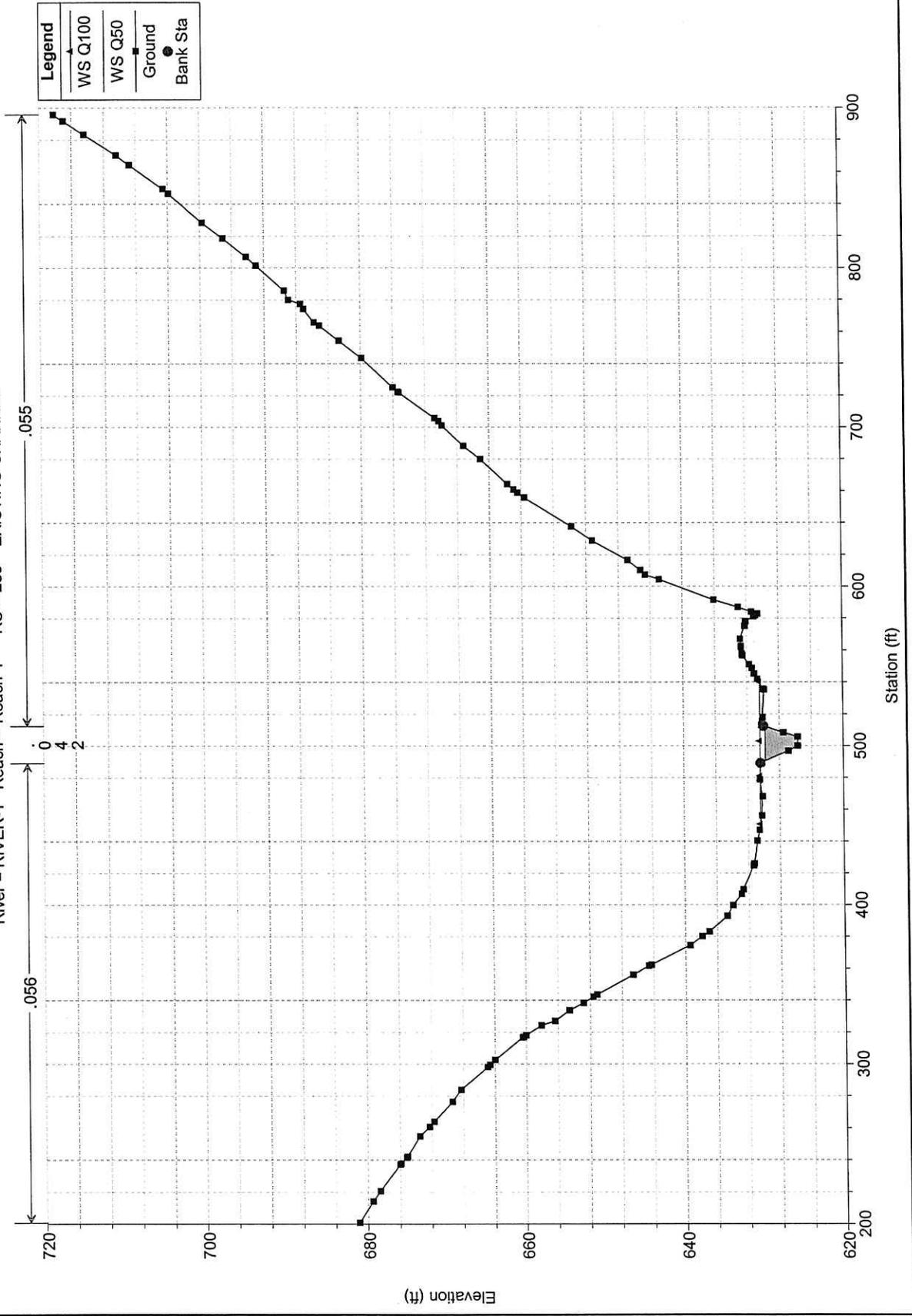
Stream 20 Plan: Stream 20 2/8/2007 10:11:06 AM
River = RIVER-1 Reach = Reach-1 RS = 537 EXISTING CHANNEL



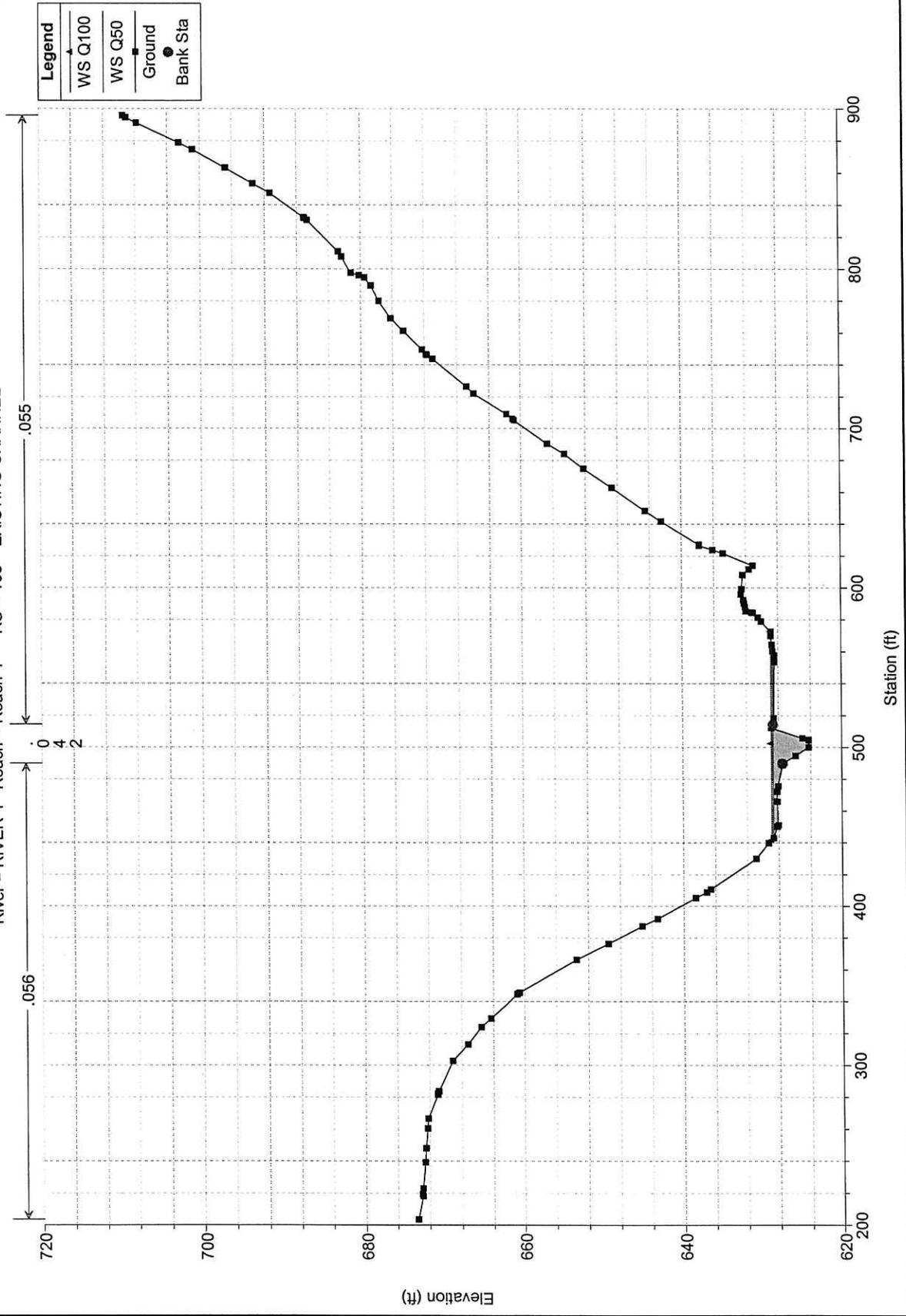
Stream 20 Plan: Stream 20 2/8/2007 10:11:06 AM
River = RIVER-1 Reach = Reach-1 RS = 436 EXISTING CHANNEL



Stream 20 Plan: Stream 20 2/8/2007 10:11:06 AM
River = RIVER-1 Reach = Reach-1 RS = 289 EXISTING CHANNEL



Stream 20 Plan: Stream 20 2/8/2007 10:11:06 AM
River = RIVER-1 Reach = Reach-1 RS = 168 EXISTING CHANNEL



**HYDRAULIC CALCULATIONS
FOR
THE PROPOSED BRIDGE**



SR 823 OVER SWAUGER VALLEY-MINFORD ROAD

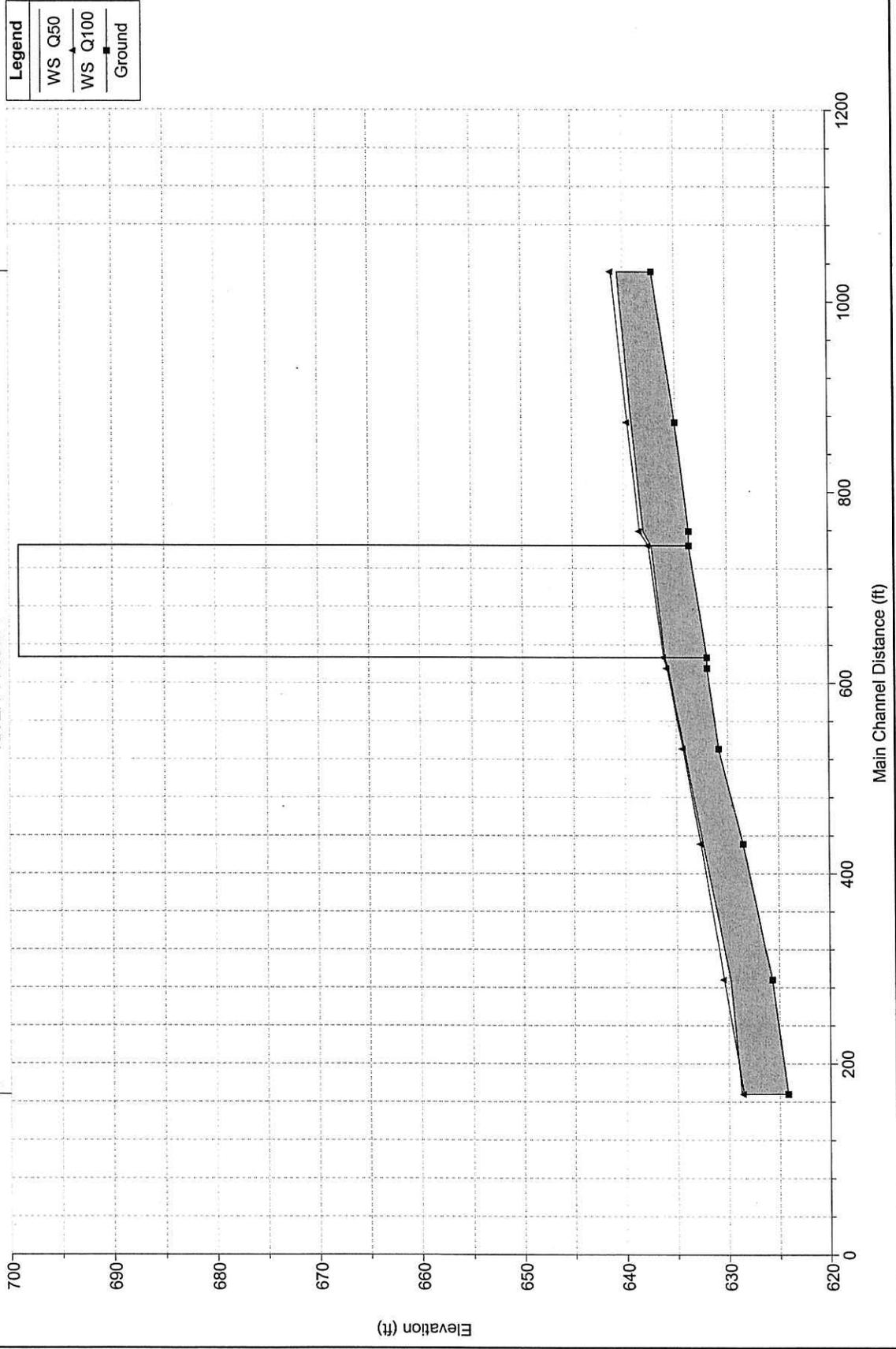
HEC-RAS FOR PROPOSED BRIDGE

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	1073	Q50	488.30	637.20	640.55	640.55	641.57	0.022204	8.14	59.97	29.40	1.00
Reach-1	1073	Q100	575.00	637.20	641.13	641.13	641.92	0.014423	7.16	85.90	68.65	0.83
Reach-1	903	Q50	488.30	635.00	639.21	637.87	639.48	0.004049	4.18	116.82	44.76	0.46
Reach-1	903	Q100	575.00	635.00	639.61	638.18	639.89	0.004020	4.23	135.99	50.99	0.46
Reach-1	780	Q50	488.30	633.70	638.13	637.33	638.78	0.009153	6.49	81.14	41.68	0.66
Reach-1	780	Q100	575.00	633.70	638.46	637.61	639.18	0.009114	6.84	96.03	47.45	0.67
Reach-1	700		Bridge									
Reach-1	621	Q50	488.30	632.00	635.75	635.75	636.21	0.010195	5.96	111.05	120.18	0.69
Reach-1	621	Q100	575.00	632.00	635.87	635.87	636.36	0.010697	6.29	125.57	122.35	0.72
Reach-1	537	Q50	488.30	630.90	634.23	634.44	634.96	0.022348	8.16	85.03	108.17	1.00
Reach-1	537	Q100	575.00	630.90	634.35	634.52	635.08	0.022167	8.36	97.54	109.28	1.00
Reach-1	436	Q50	488.30	628.50	632.46	632.71	633.21	0.014054	7.64	86.26	87.24	0.80
Reach-1	436	Q100	575.00	628.50	632.68	632.81	633.30	0.014136	7.25	106.85	102.71	0.79
Reach-1	289	Q50	488.30	625.70	629.80	629.66	630.95	0.018574	8.62	56.67	21.68	0.94
Reach-1	289	Q100	575.00	625.70	630.43	630.48	631.36	0.012640	7.86	84.05	77.39	0.79
Reach-1	168	Q50	488.30	624.20	628.73	628.73	629.30	0.008710	6.46	104.10	116.64	0.66
Reach-1	168	Q100	575.00	624.20	628.52	628.92	629.61	0.016629	8.68	81.77	76.51	0.91

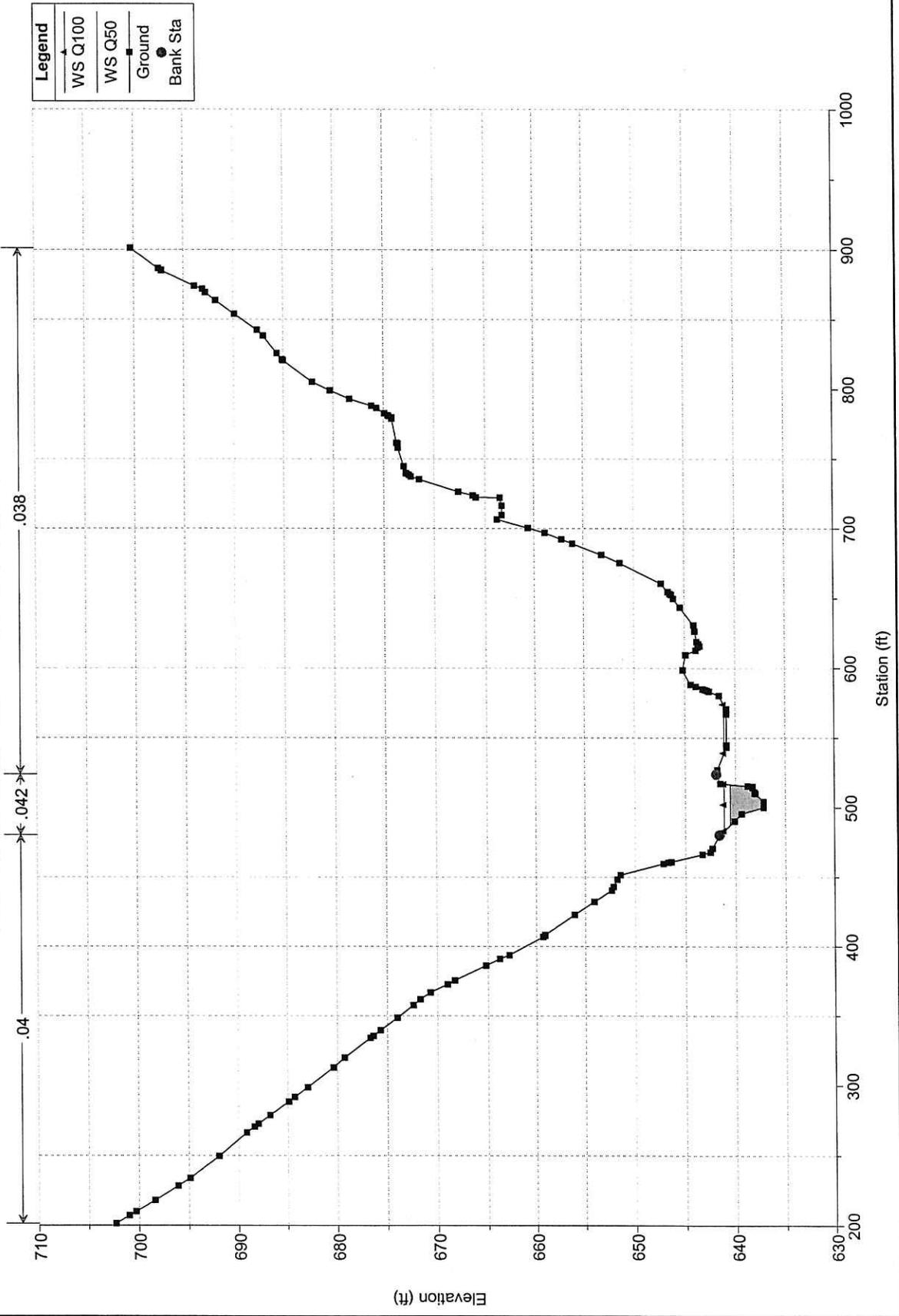
Stream 20 Plan: Bridge&Stream20 2/15/2007 3:13:42 PM

PROPOSED BRIDGE

RIVER-1 Reach-1

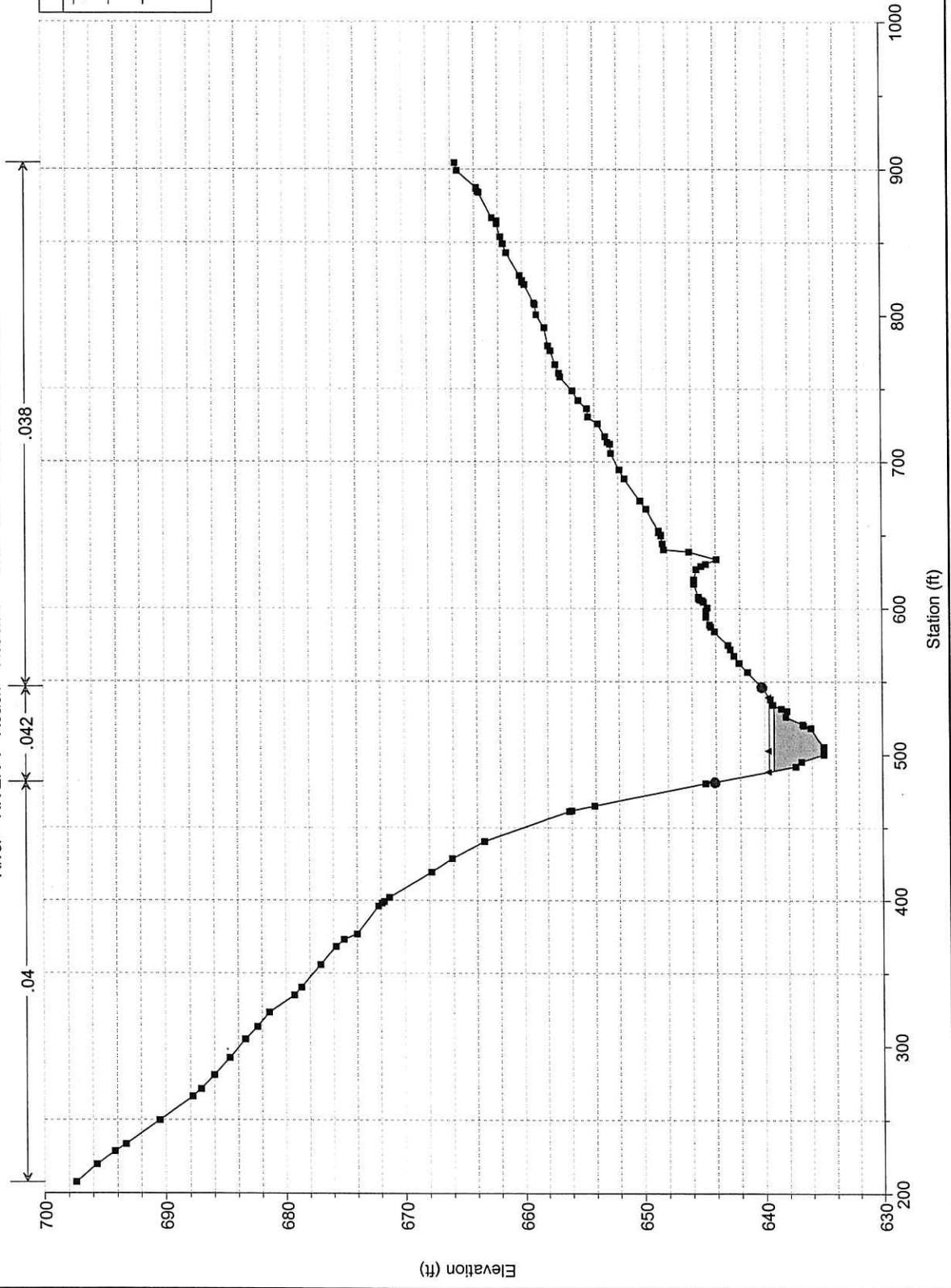


Stream 20 Plan: Bridge&Stream20 2/15/2007 3:13:42 PM
River = RIVER-1 Reach = Reach-1 RS = 1073 PROPOSED BRIDGE



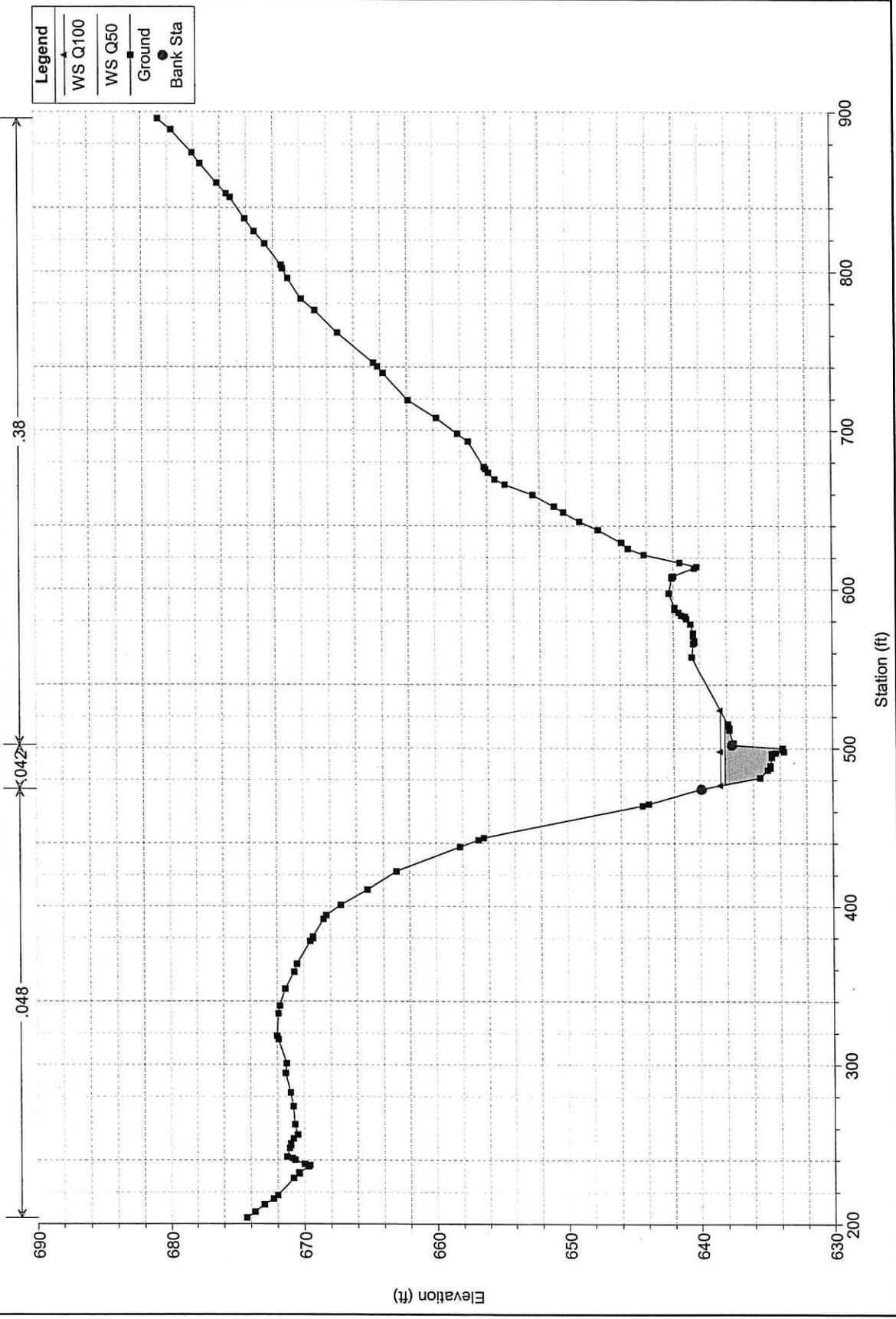
Stream 20 Plan: Bridge&Stream20 2/15/2007 3:13:42 PM
 River = RIVER-1 Reach = Reach-1 RS = 903 PROPOSED BRIDGE

Legend	
—▲—	WS Q100
—■—	WS Q50
—●—	Ground
—○—	Bank Sta

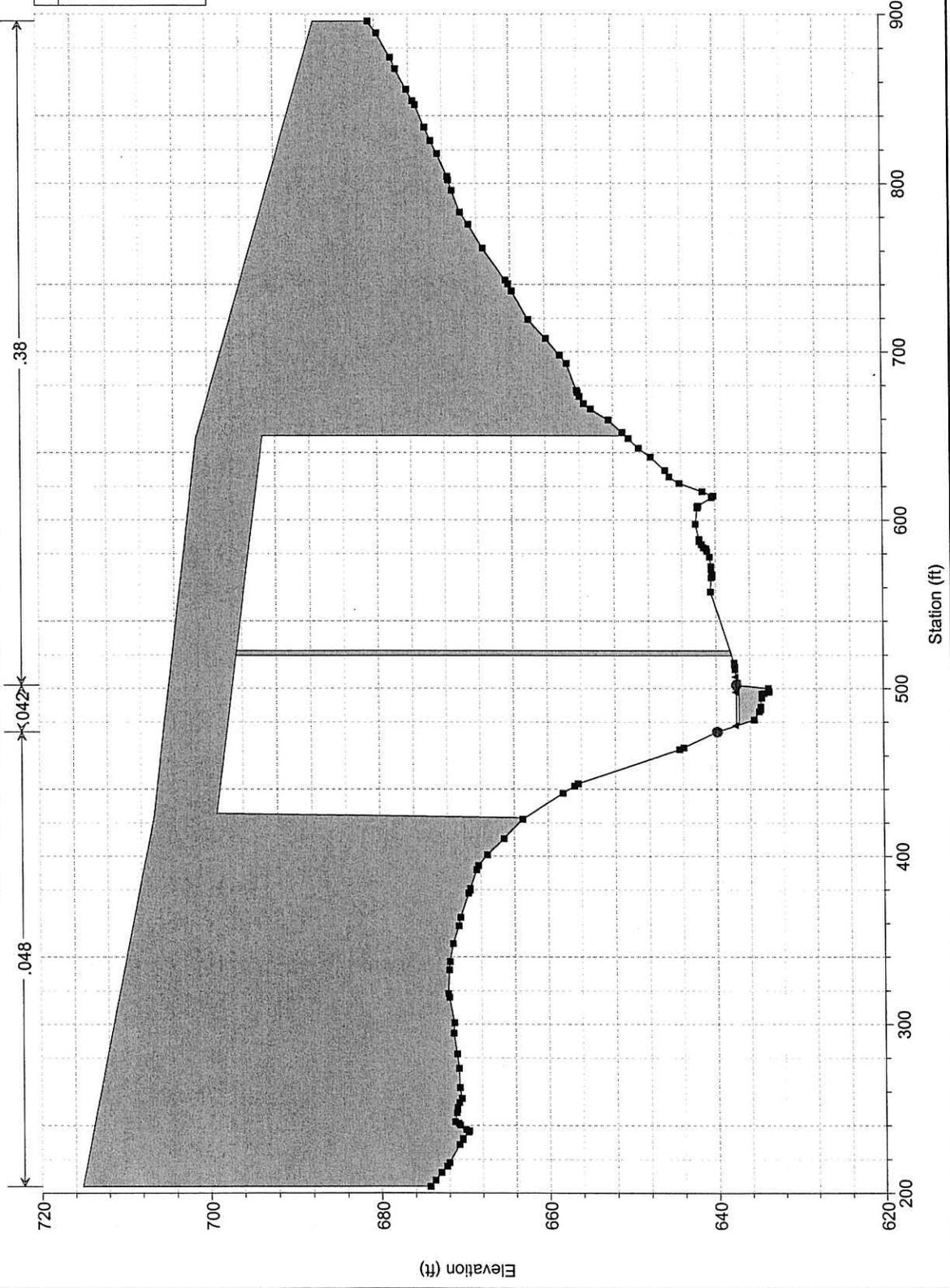


Stream 20 Plan: Bridge&Stream20 2/15/2007 3:13:42 PM

River = RIVER-1 Reach = Reach-1 RS = 780 PROPOSED BRIDGE

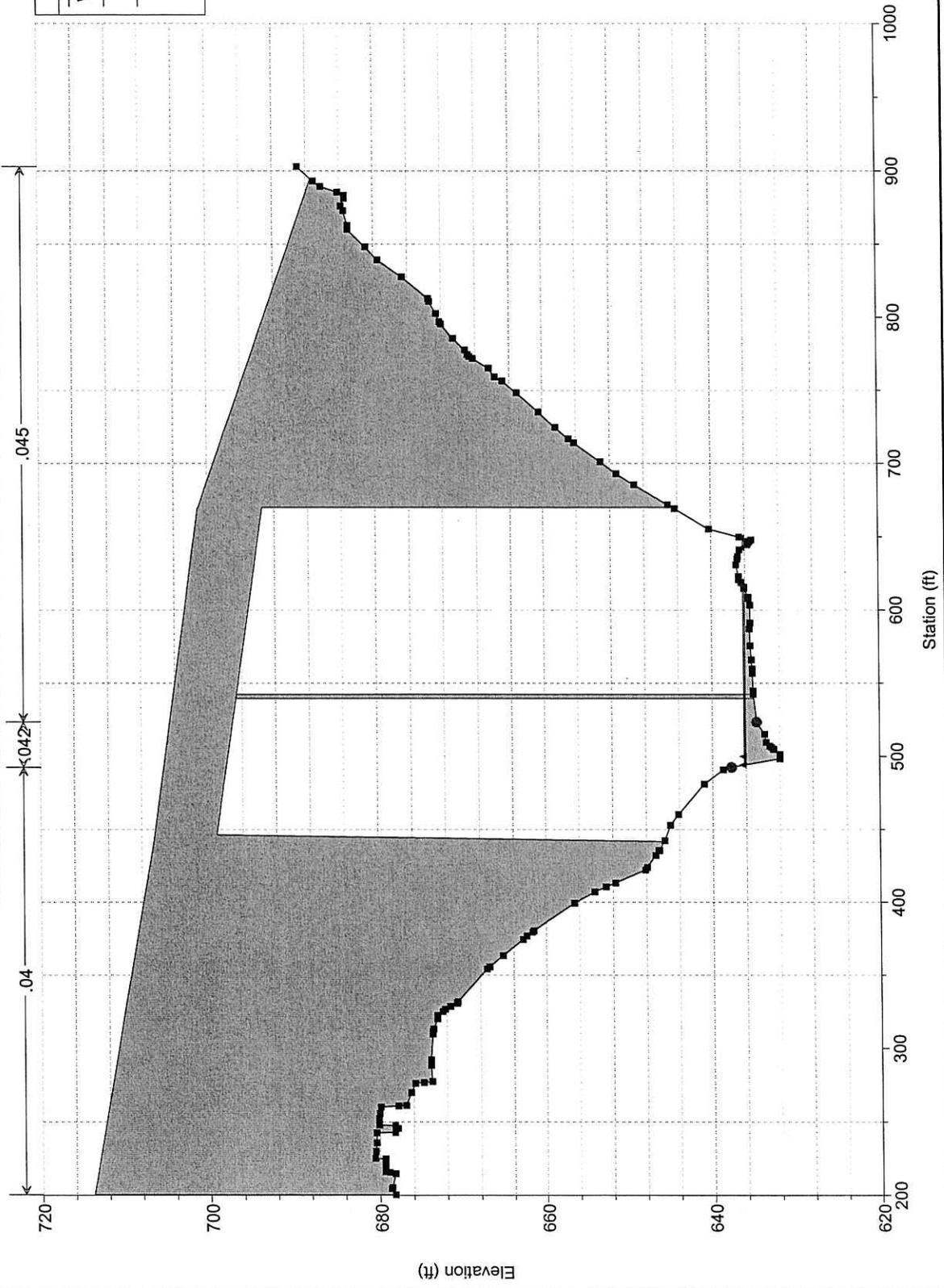


Stream 20 Plan: Bridge&Stream20 2/15/2007 3:13:42 PM
River = RIVER-1 Reach = Reach-1 RS = 700 BR PROPOSED BRIDGE



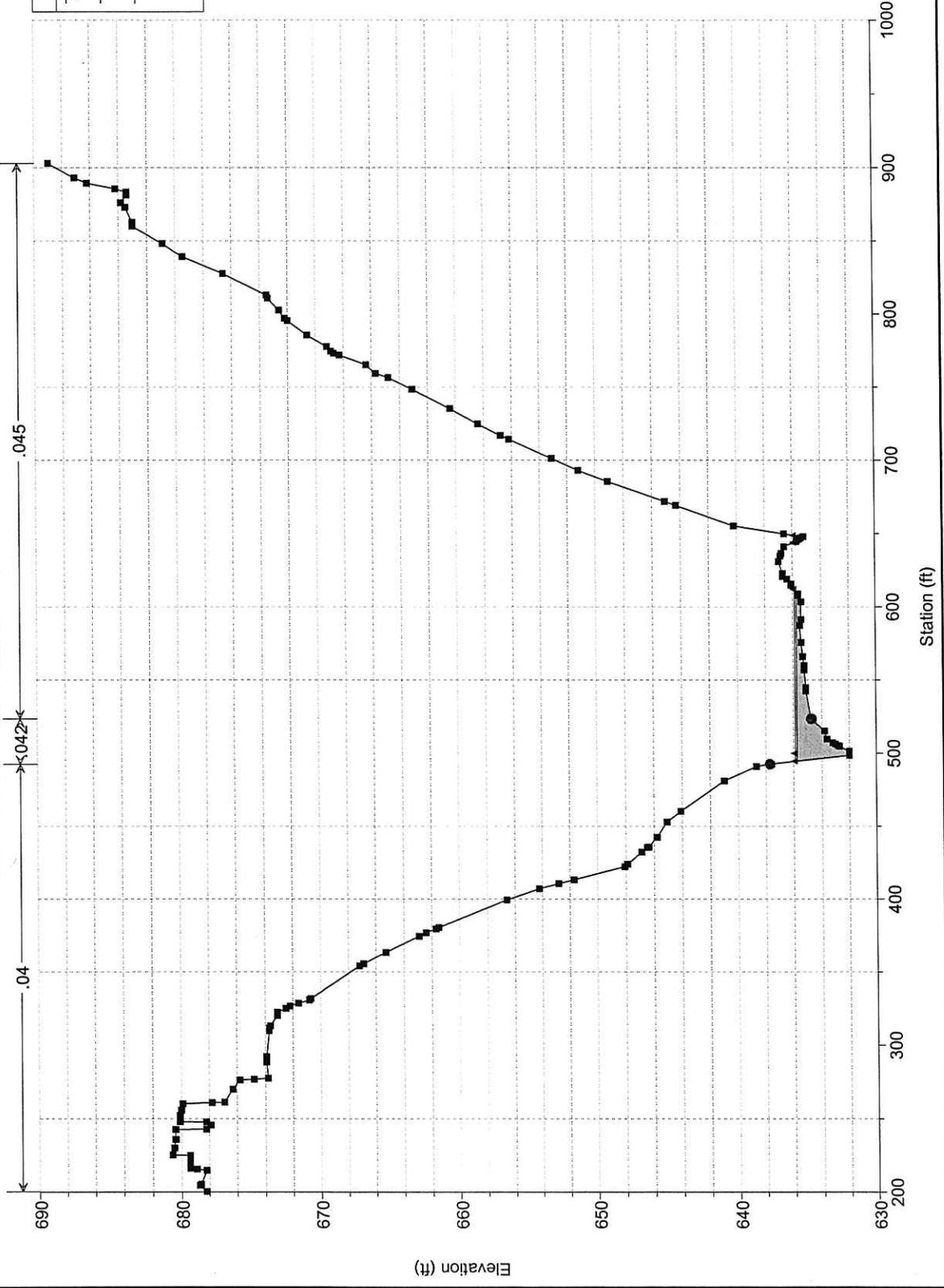
Stream 20 Plan: Bridge&Stream20 2/15/2007 3:13:42 PM
 River = RIVER-1 Reach = Reach-1 RS = 700 BR PROPOSED BRIDGE

Legend	
—	WS Q100
—	WS Q50
—	Ground
●	Bank Sta



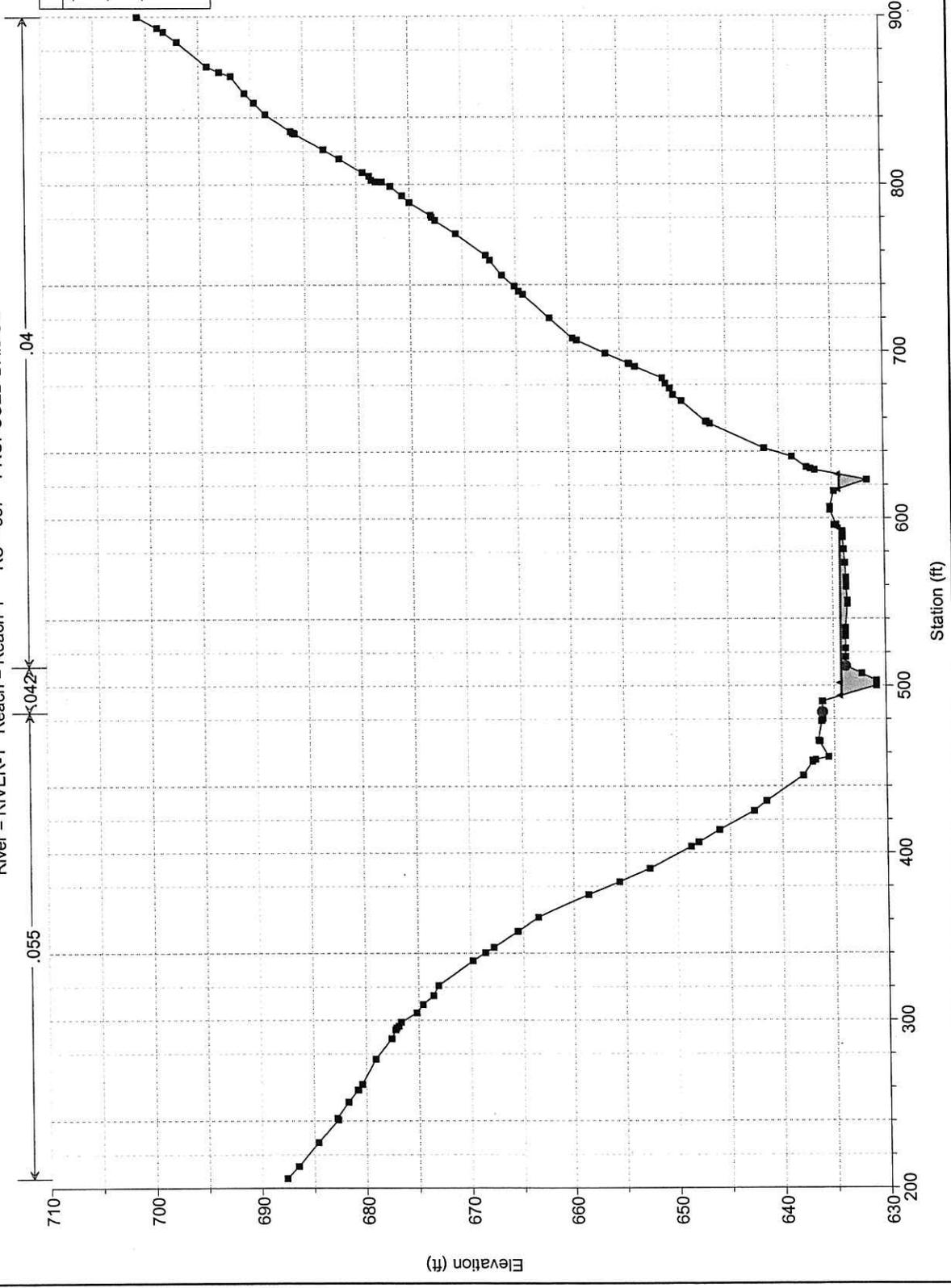
Stream 20 Plan: Bridge&Stream20 2/15/2007 3:13:42 PM
River = RIVER-1 Reach = Reach-1 RS = 621 PROPOSED BRIDGE

Legend	
—▲—	WS Q100
—■—	WS Q50
—●—	Ground
●	Bank Sta



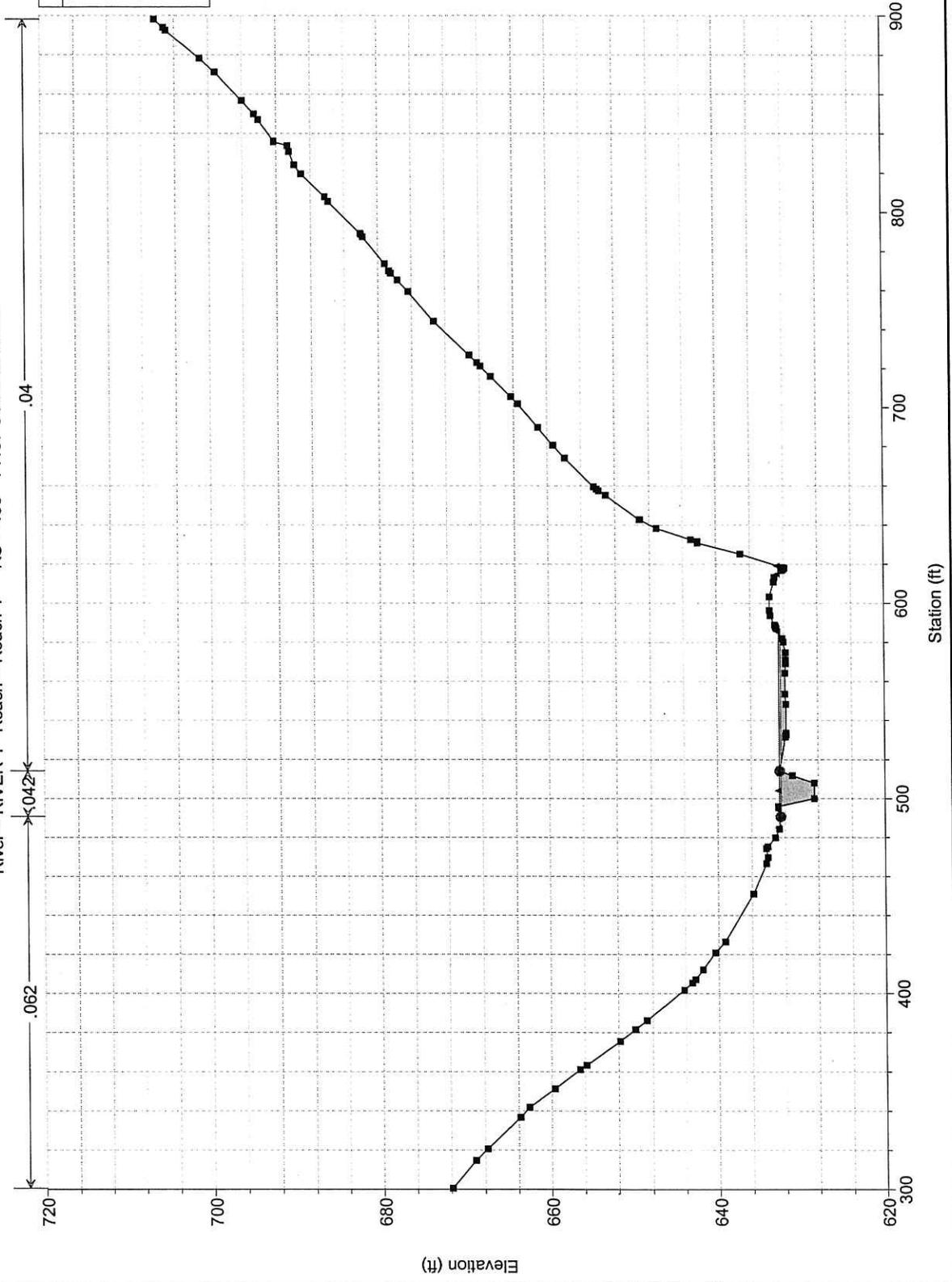
Stream 20 Plan: Bridge&Stream20 2/15/2007 3:13:42 PM
 River = RIVER-1 Reach = Reach-1 RS = 537 PROPOSED BRIDGE

Legend	
—	WS Q100
—	WS Q50
■	Ground
●	Bank Sta

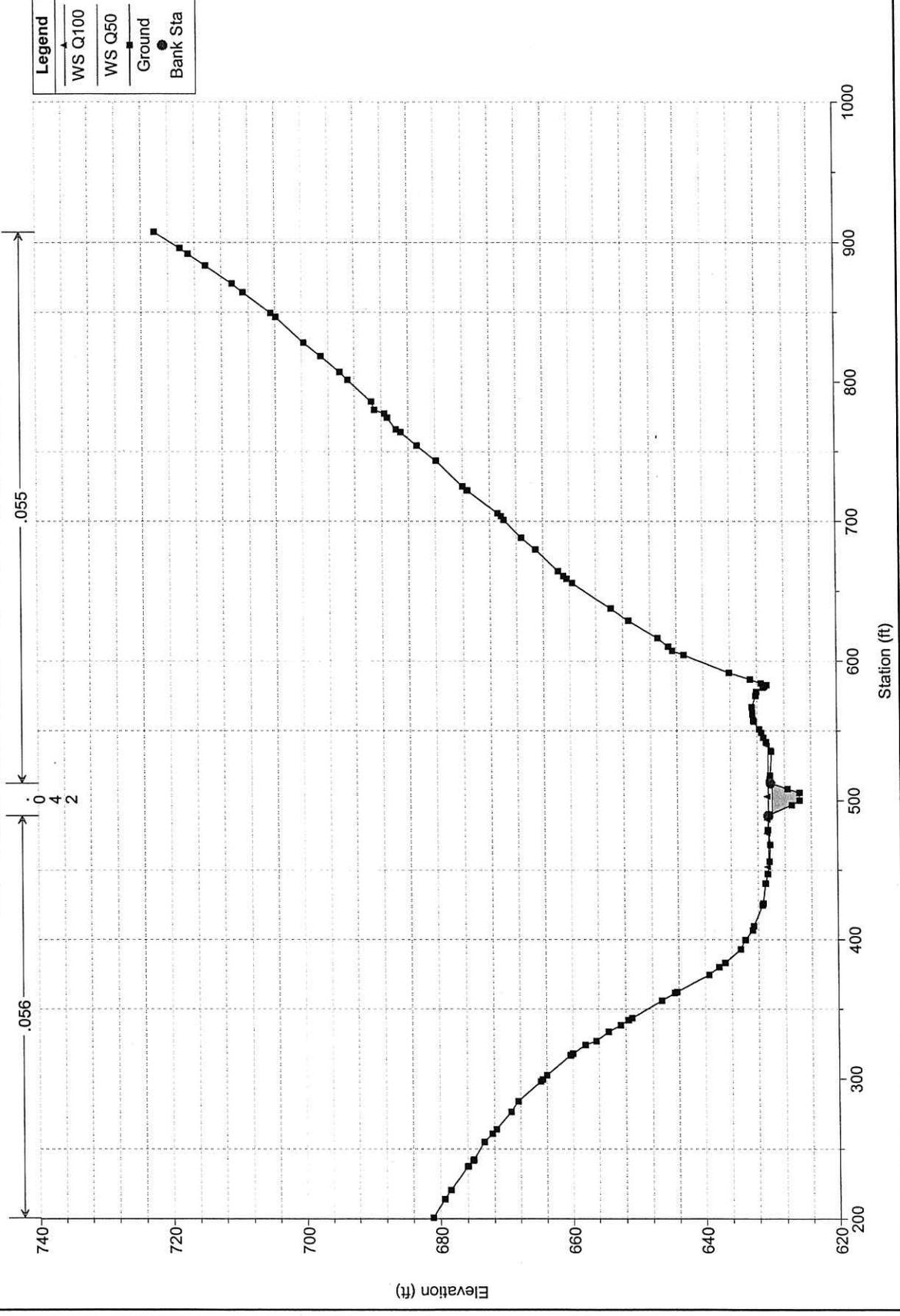


Stream 20 Plan: Bridge&Stream20 2/15/2007 3:13:42 PM
 River = RIVER-1 Reach = Reach-1 RS = 436 PROPOSED BRIDGE

Legend	
—	WS Q100
—	WS Q50
■	Ground
●	Bank Sta



Stream 20 Plan: Bridge&Stream20 2/15/2007 3:13:42 PM
 River = RIVER-1 Reach = Reach-1 RS = 289 PROPOSED BRIDGE



Stream 20 Plan: Bridge&Stream20 2/15/2007 3:13:42 PM
River = RIVER-1 Reach = Reach-1 RS = 168 PROPOSED BRIDGE

